# A Look at the Dijet Mass Resolution Using CMSSW 1.3.4

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# Introduction

Updating previous study using newer software and simulation

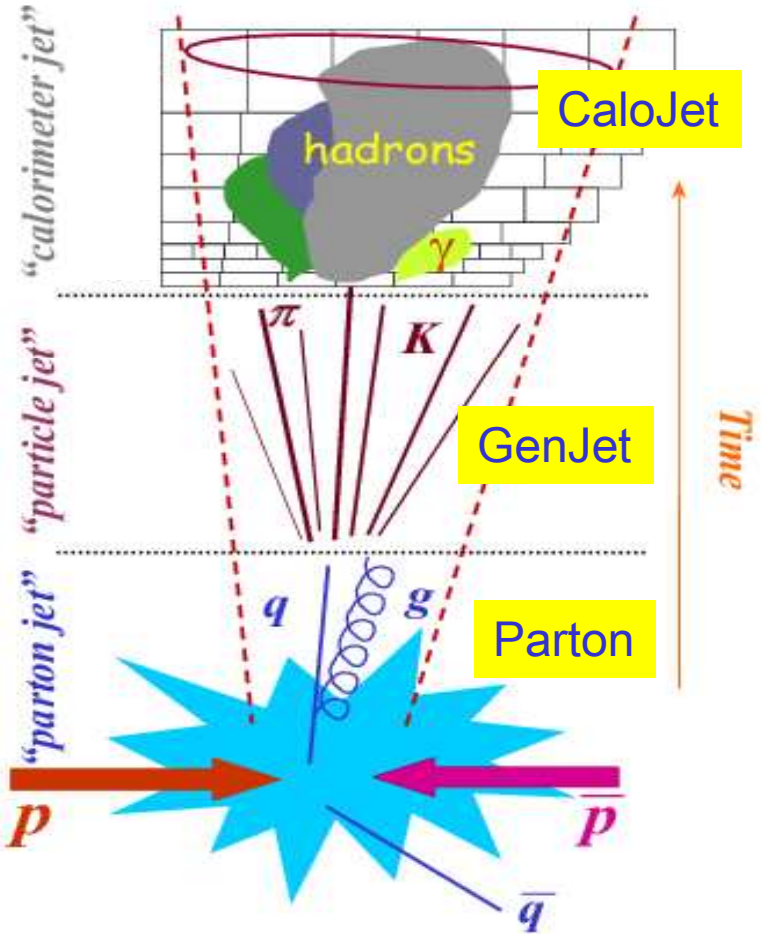
- Using CMSSW 1.3.4
- Z prime to dijet sample
- About 35000 events at three different mass points
  700, 2000, 5000 GeV

Zprime samples not available in CMSSW 1.6.x

⇒ Need to run on cmsuaf

| | |
|---|---|
| Parton: | Generated Level |
| GenJet: | Algorithm run on stable particles |
| CaloJet: | Algorithm run on calorimeter energy deposits |
| CorrCaloJets: | Jet corrections applied to CalJet |

# What We Measure




Going from particles to the Calorimeter involves detector effects such as resolution, undetected energy, smearing

Going from partons to particles involves QCD + fragmentation and depends on modeling

# What We Measure

- Looked at the two leading jets
- No matching requirement

Using:

midPointCone5CaloJets
midPointCone5GenJets

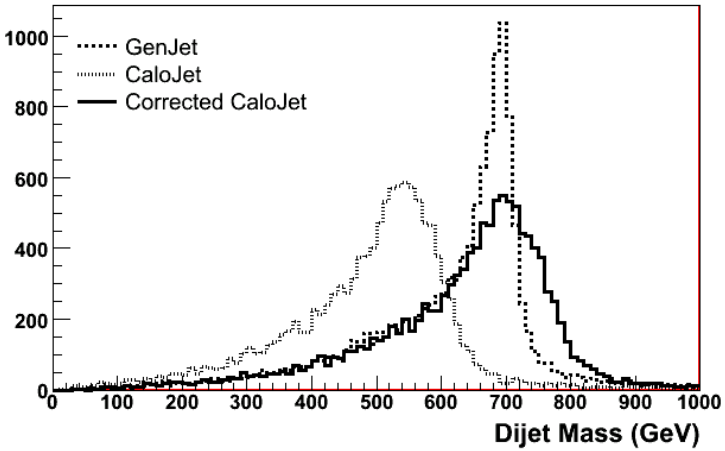
Apply jet corrections on the fly:

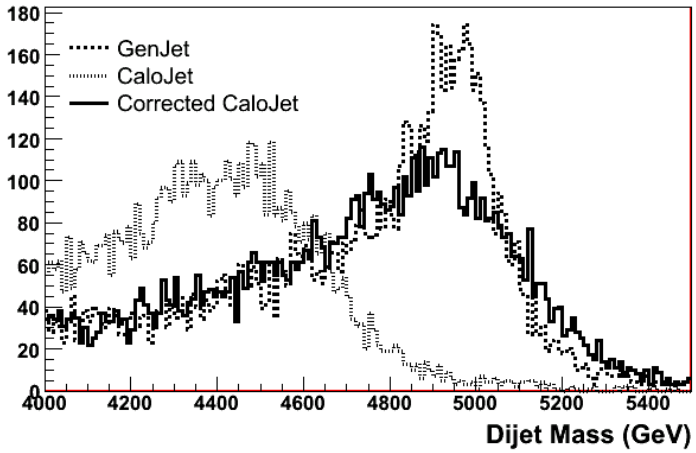
MCJetCorrectionSpring07.cff
MCJetCorrectorMcone5

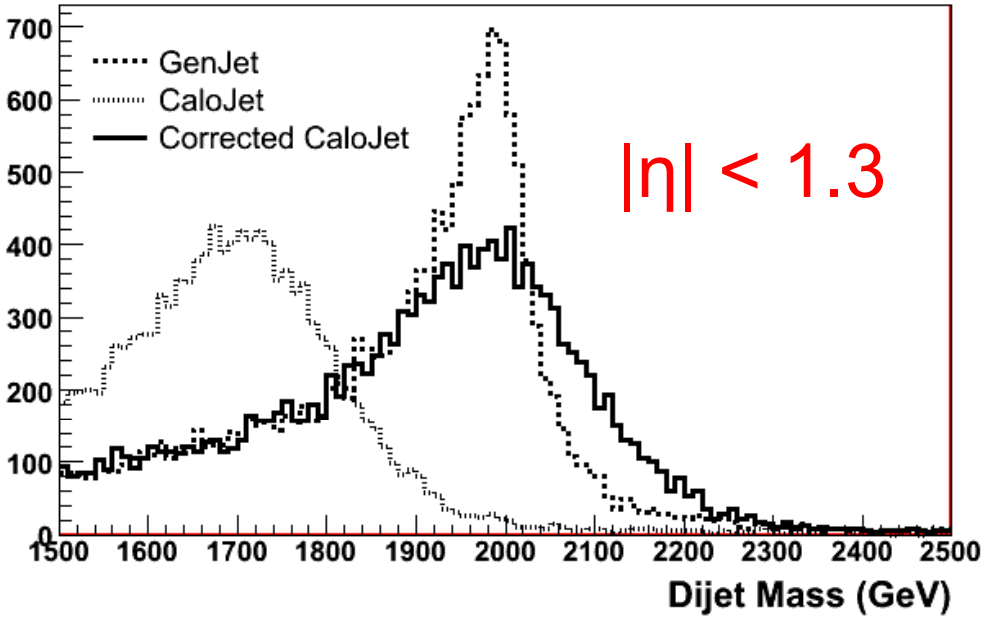
Code location:

/uscms_data/d1/chlebana/CMSSW_1_3_4/src/
RecoJets/JetAnalyzers/src/JetCompare.cc

# Dijet Mass Comparison



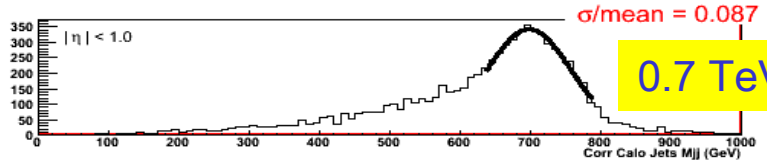



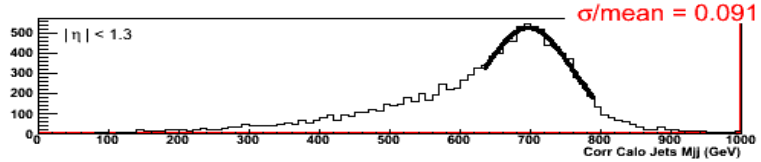

Dijet mass comparison of

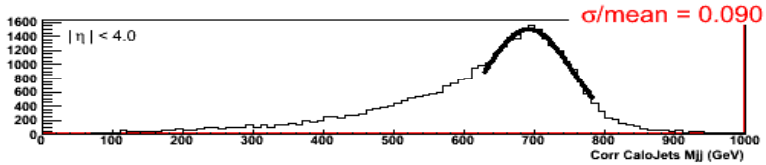
- *GenJet*
- *CaloJet*
- *Corrected CaloJet*

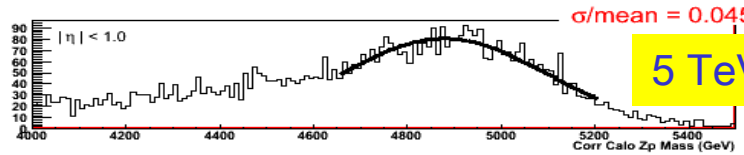
# Expanding the η Range



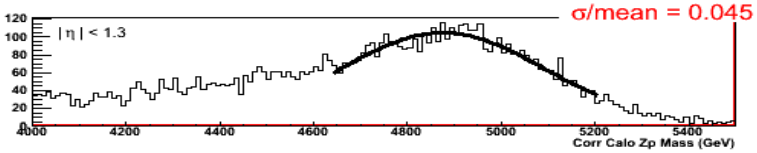

0.7 TeV

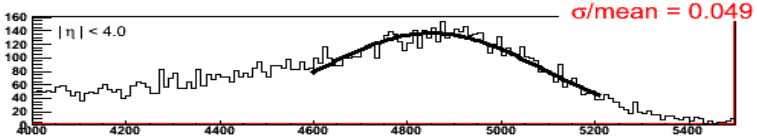


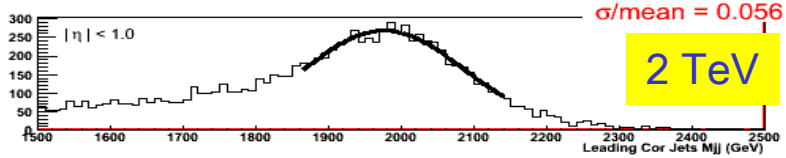



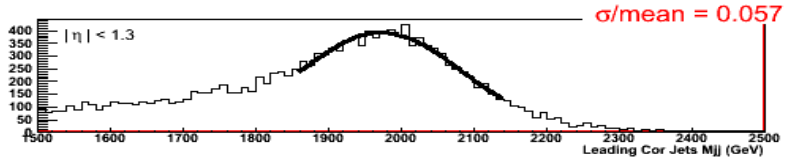

5 TeV

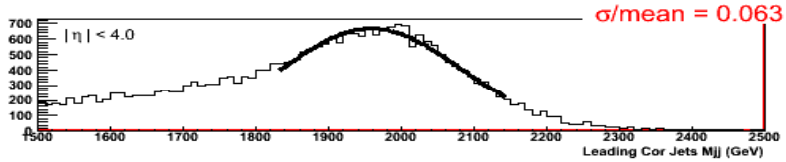



2 TeV



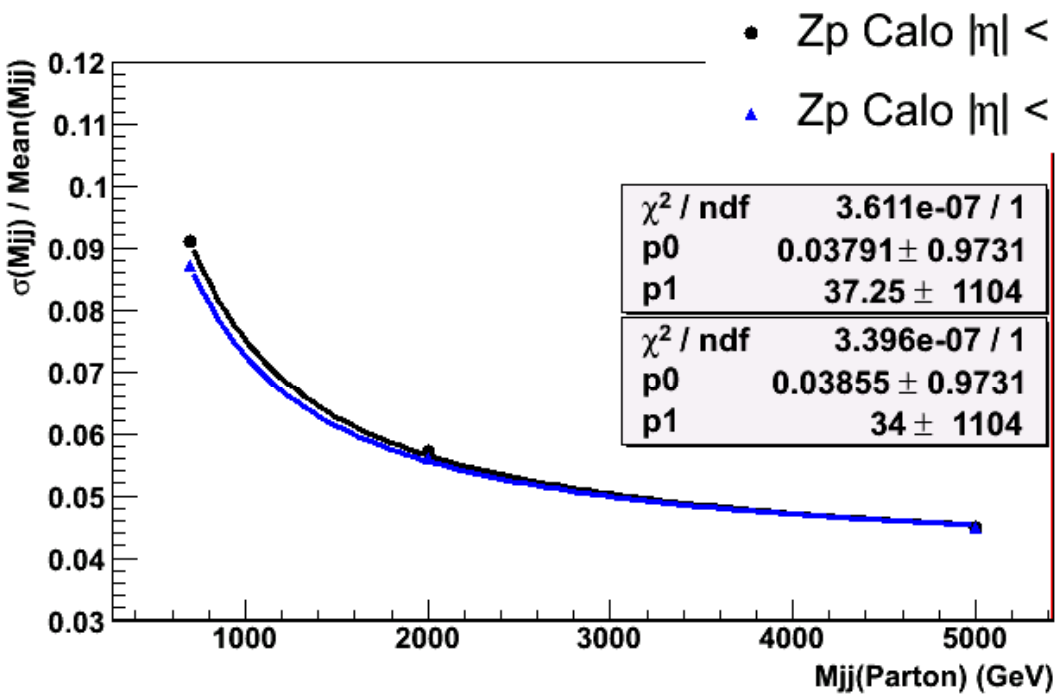




Original studies were done for |η| < 1.0

Resolution shown for three regions: |η| < 1.0, |η| < 1.3, and |η| < 4.0

*→ Similar resolutions for the different psuedo rapidity regions*

# Resolution in Expanded η Region

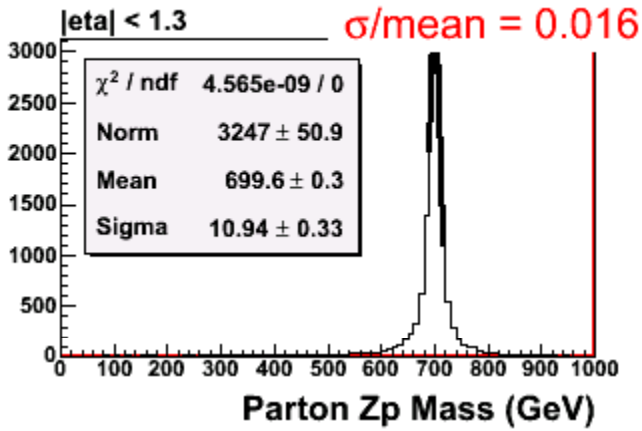


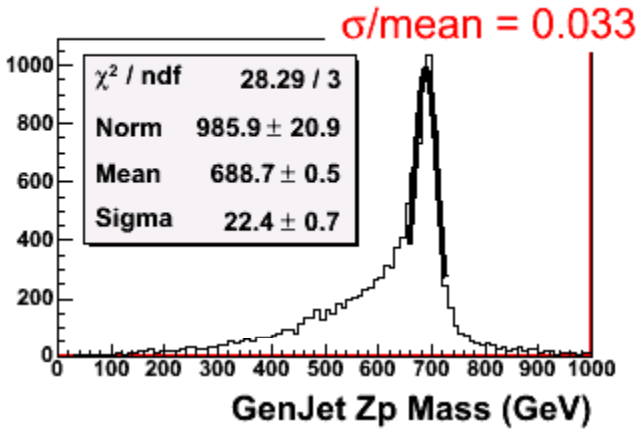

Points are fit to the function:

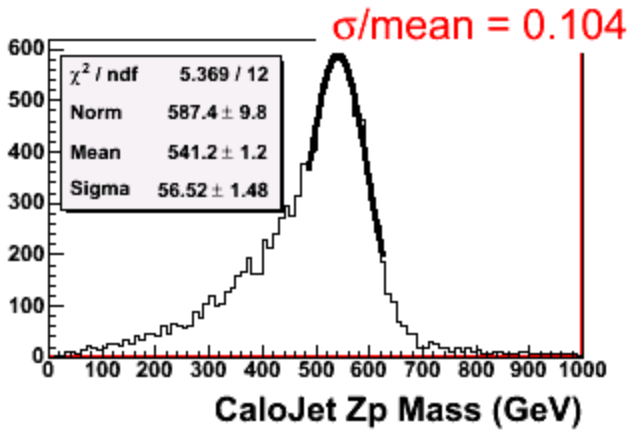
$$\mathrm{res} = \mathrm{p0} + \frac{\mathrm{p1}}{\mathrm{mass}}$$

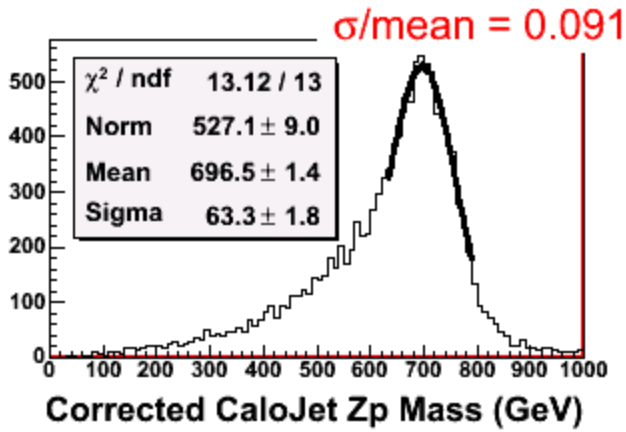
*Resolution in expanded η region is comparable to the original region*

# Mass Resolution: 0.7 TeV

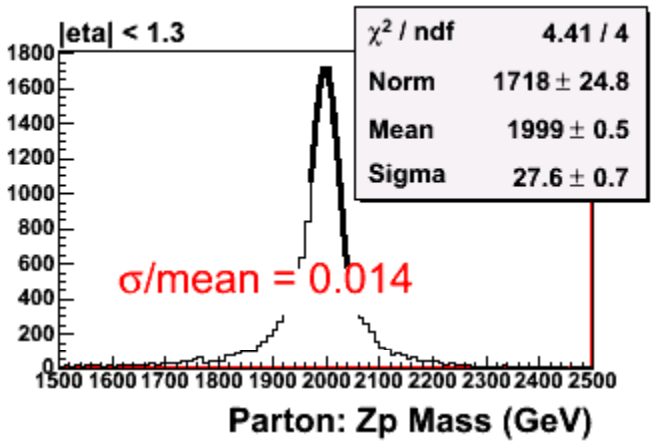


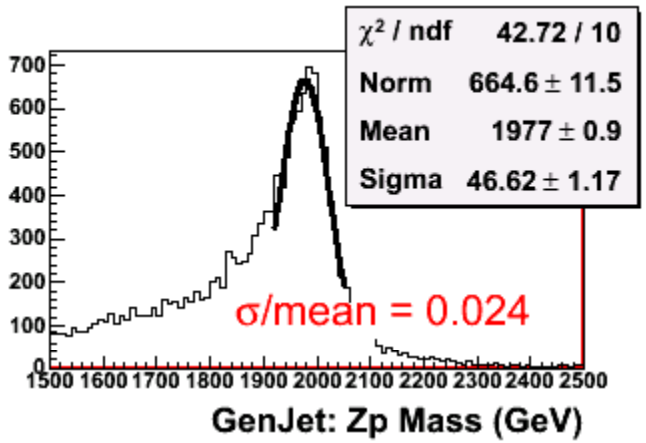



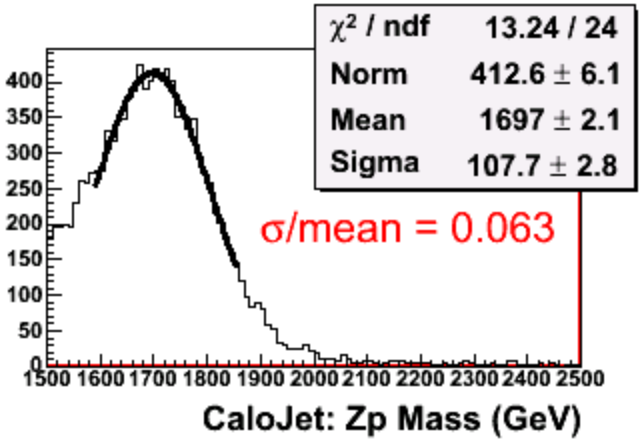



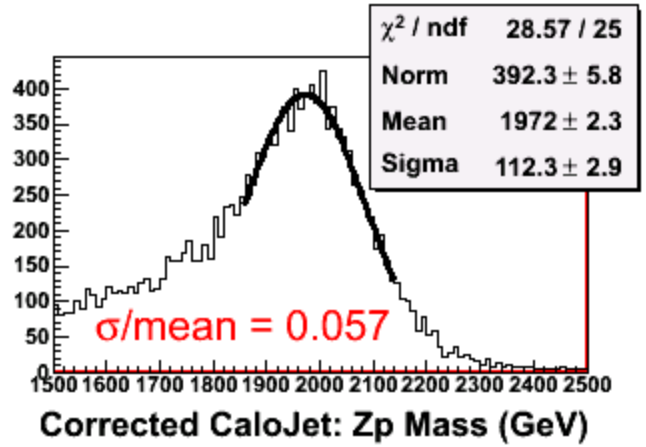



# Mass Resolution: 2 TeV

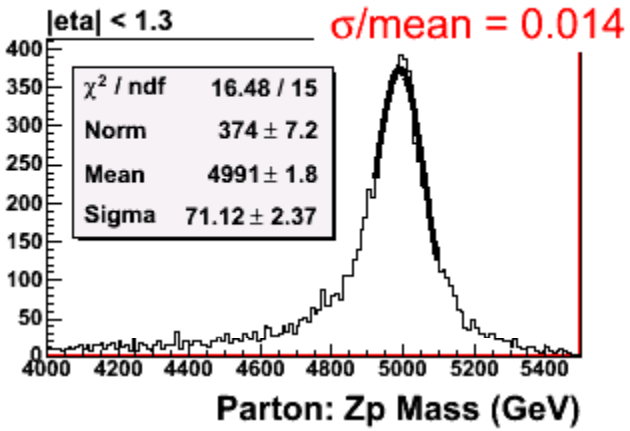


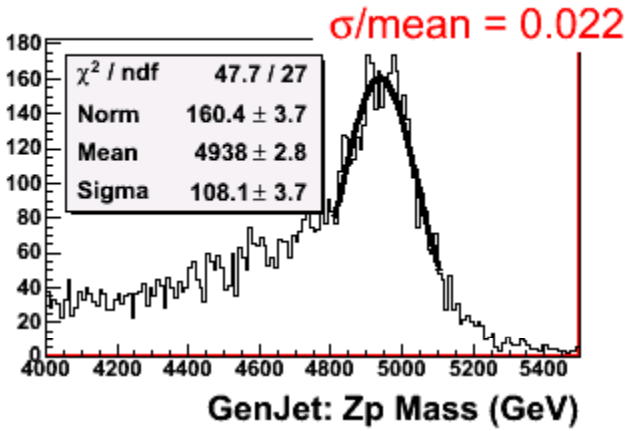



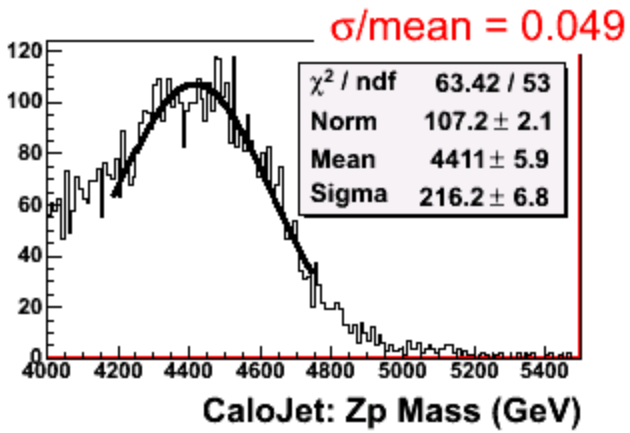



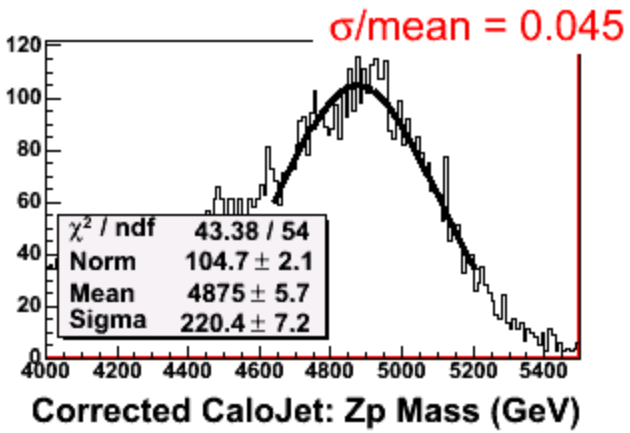



# Mass Resolution: 5 TeV

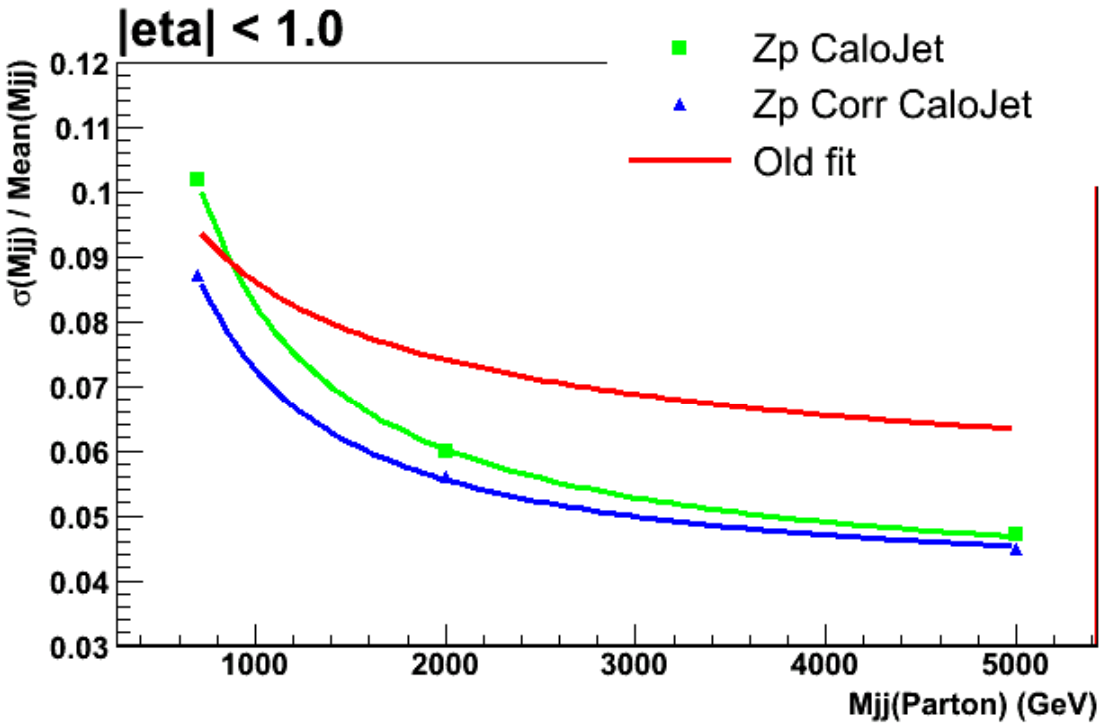


# Dijet Mass Resolution

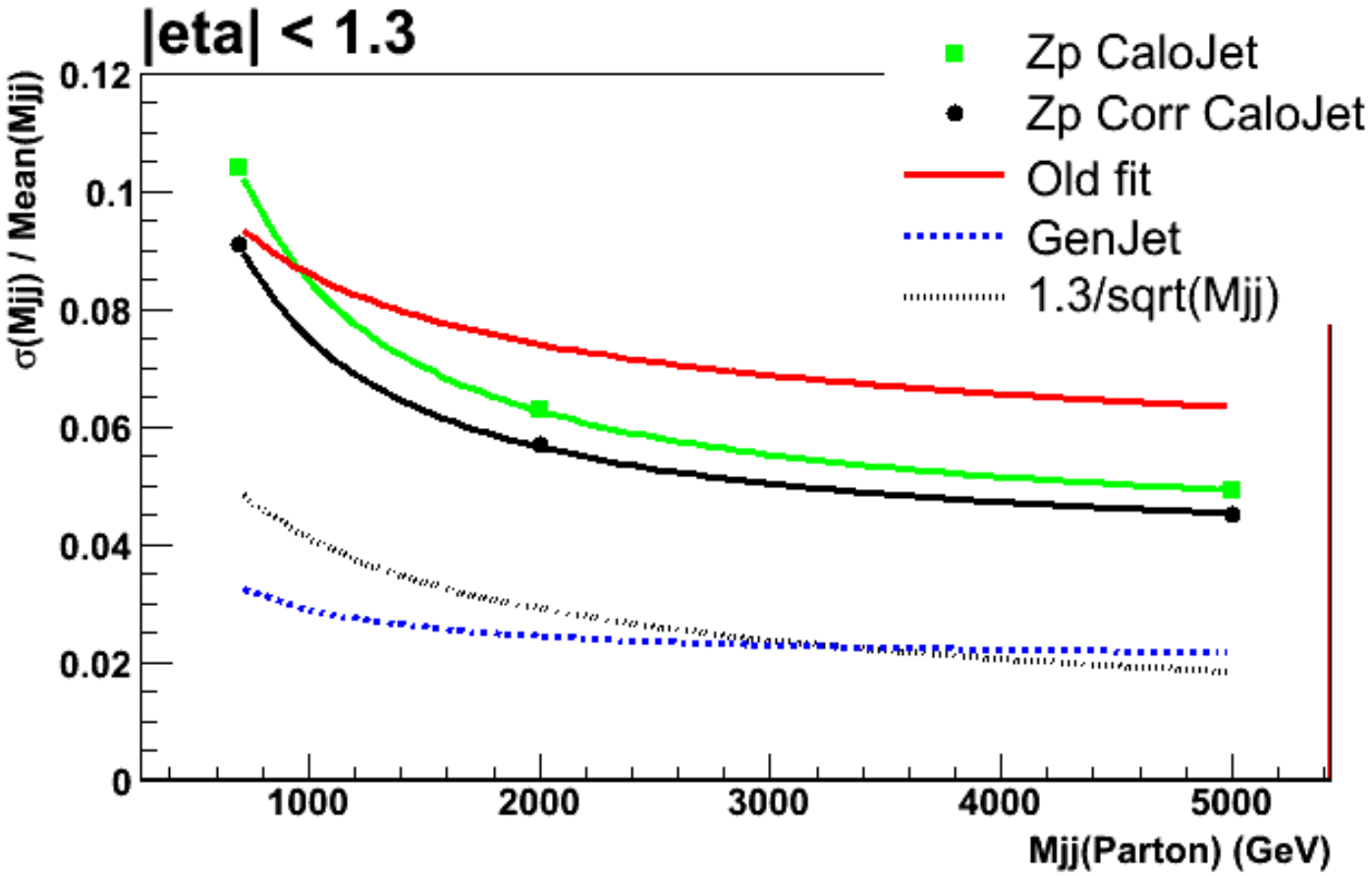



See better resolutions compared with the old study

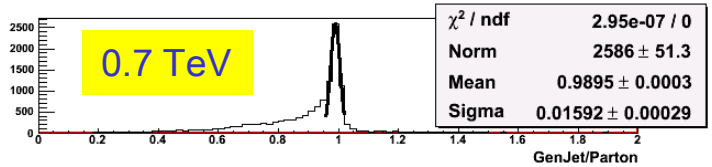
Raw jet resolutions are comparable to the corrected jet resolutions

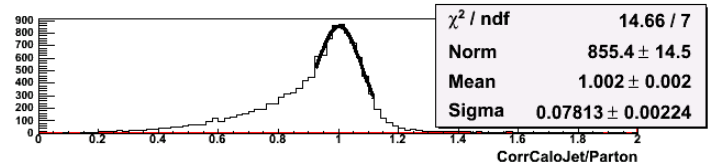
*Could look for bumps using a smooth fit to the raw distribution*

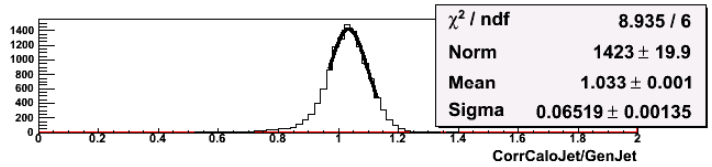
# Dijet Mass Resolution

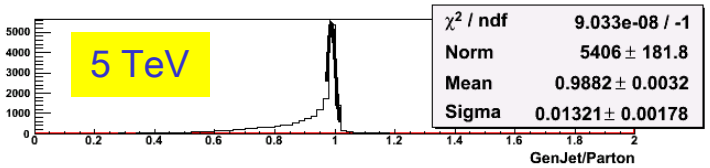


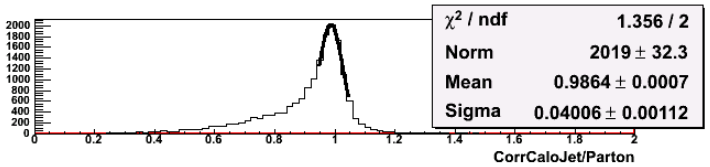
# Intrinsic Resolution

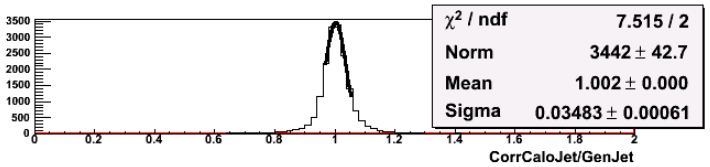


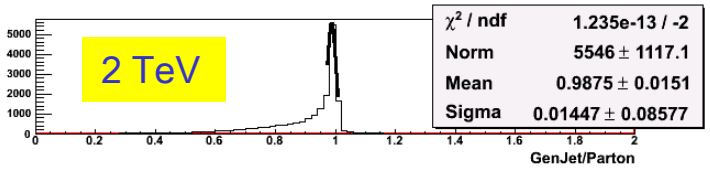



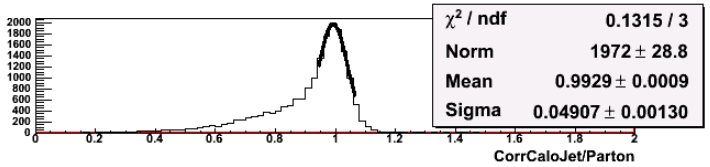



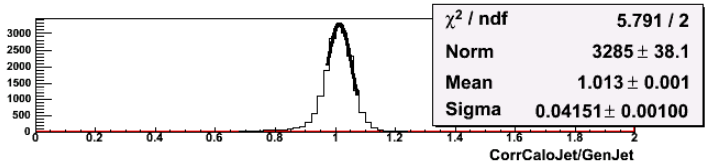



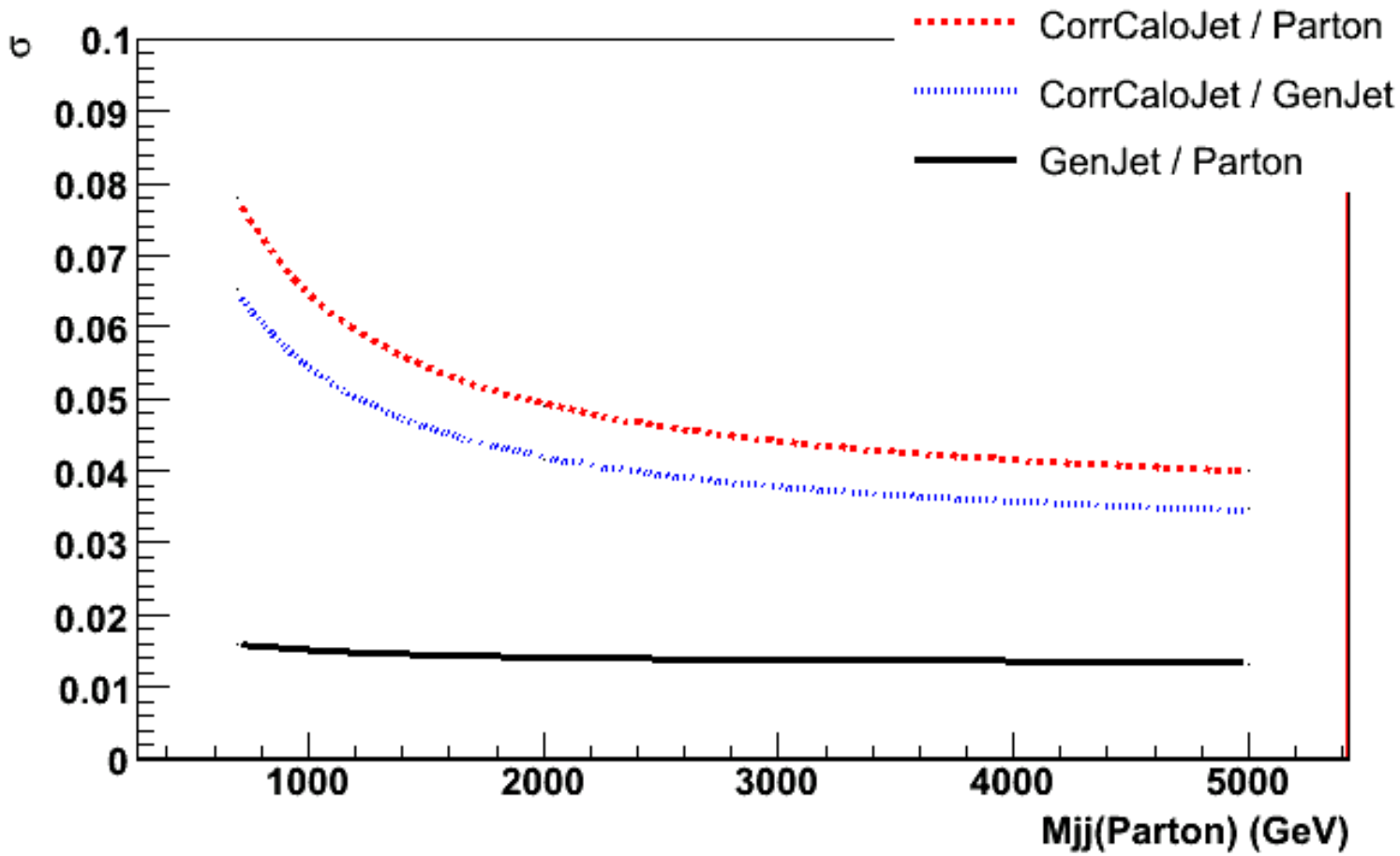



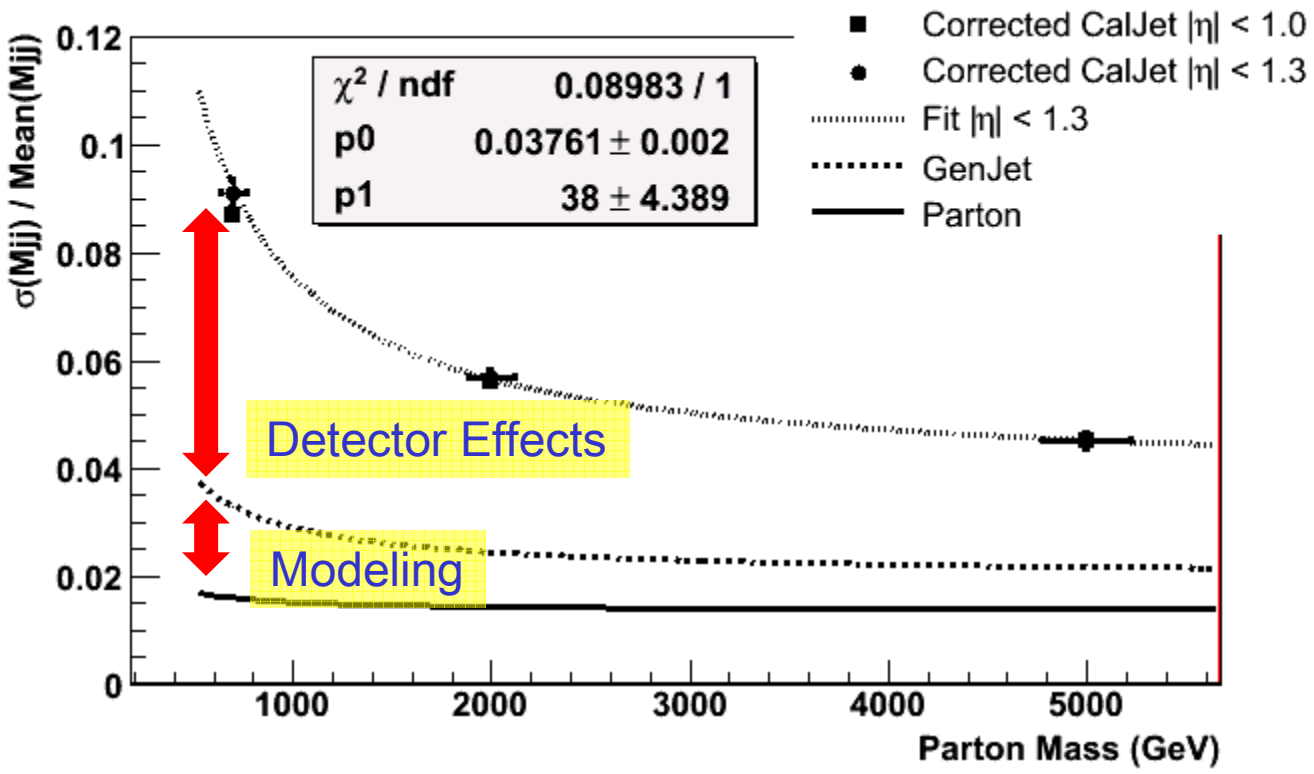




- GenJet/Parton
- CorrCaloJet/Parton
- CorrCaloJet/GenJet

# Intrinsic Resolution



# Dijet Mass Resolution




*Mass error taken from the σ of the fit*
*Error on σ/mean is propagated from the fit*

# Improving the Resolution

- Jet corrections sets the energy scale but only *modestly* improved the energy resolution

- Need to include additional information to further improve the mass resolution
  - Use tracking information to reconstruct the hadronic component of the jet

# Conclusions

- Resolution study has been updated using more statistics and CMSSW 1.3.4
  - *Observe better resolutions than were seen with previous studies*
- See similar resolutions for the expanded pseudo rapidity region ($|\eta| < 1.0 \rightarrow |\eta| < 1.3$)
  - *Able to include more data!*
- Raw jet resolutions comparable to corrected jet resolutions
  - *For bump searches, can start with uncorrected mjj and compare to a smooth parameterization of the data*

# Additional Slides